PATENT ABSTRACTS OF JAPAN

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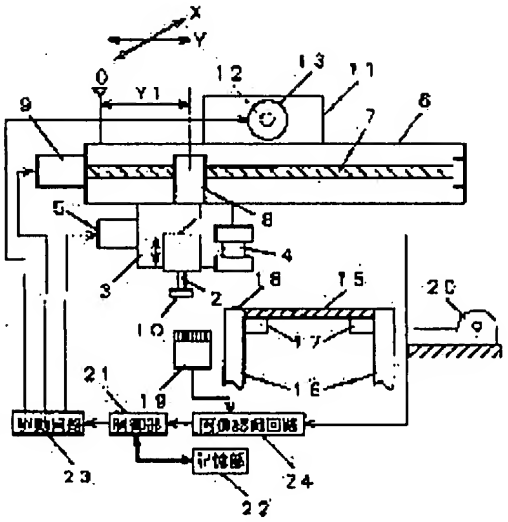
(54) METHOD OF MOUNTING CHIP

(57)Abstract:

PURPOSE: To eliminate lowering of mounting precision caused by change of a relative position of a head and a camera due to thermal expansion of a holder wherein a head and a camera are built integrally which is caused by heat generation of a motor for moving a nozzle up and down.

CONSTITUTION: Misalignment of a nozzle 2 due to thermal expansion of a holder 3 caused by heat generation of a motor 5 which drives a head is detected by a camera 19 for chip recognition. The misalignment is found by observing a mark 18 formed in a specified position by a camera 4 for substrate recognition. Thereafter, a chip 10 is transferred and mounted on a substrate 15 while movement stroke of a head is corrected based on the determined misalignment.



LEGAL STATUS

[Date of request for examination] 21.04.1999

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[Kind of final disposal of application other than

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the mounting approach of the chip for carrying out automatic loading of the chip at the position of a substrate.
[0002]
[Description of the Prior Art] Various chips (electronic parts), such as IC, LSI, a flip chip, a resistor chip, and a chip capacitor, are carried in the position of a substrate by electronic-parts mounting equipment. Electronic-parts mounting equipment is equipped with the head which has the nozzle which carries out vacuum adsorption of the chip, and it carries the chip with which the parts feeder was equipped in a substrate, making the horizontal migration of the head carry out in the direction of X, or the direction of Y.
[0003] Hereafter, the mounting approach of the chip by conventional electronic-parts mounting equipment is explained. The side elevation of the electronic-parts mounting equipment of the former [drawing 13] and drawing 14 are the recognition image Figs. of this mark. In drawing 13 , 1 is a head and is equipped with the nozzle 2. The head 1 is held at the holder 3. The camera 4 a head 1 and for substrate recognition is attached to the holder 3 in one. 5 is the motor with which the holder 3 was equipped, and when this motor 5 drives, a nozzle 2 performs vertical actuation. In addition, transmission systems, such as a pulley for carrying out vertical actuation of the nozzle 2 and a belt, are omitting.
[0004] 6 is Y table and is equipped with the feed screw 7 of the direction of Y. The nut 8 is combined with the upper part of a holder 3, and the nut 8 is screwed in a feed screw 7. Therefore, if the Y motor 9 drives and a feed screw 7 rotates, a holder 3 will move in the direction of Y along with a feed screw 7. 11 is X table and is equipped with the feed screw 12 of the direction of X. The X table 11 and the Y table 6 intersect perpendicularly mutually, and are connected. Therefore, if the X motor 13 drives and a feed screw 12 rotates, the Y table 6 will move in the direction of X along with a feed screw 12, and, thereby, a holder 3 will also move it in the direction of X. That is, the Y table 6 and the X table 11 serve as migration equipment for making the horizontal migration of the camera 4 for substrate recognition carry out in the direction of X, or the direction of Y to a head 1 in one.
[0005] 15 is a substrate. A substrate 15 is conveyed in the direction of X by conveyor 17 along with a guide rail 16. The mark 18 is formed in the proper places on a guide rail 16 etc. The camera 19 for chip recognition is installed in the side of a guide rail 16. The camera 19 for this chip recognition observes the chip 10 by which vacuum adsorption was carried out from a lower part for a nozzle 2, and detects that location. 20 is a parts feeder and is installed in the side of a guide rail 16. As a parts feeder 20, the tape feeder, the tube feeder, etc. are used abundantly. The parts feeder 20 is equipped with the chip 10 of various forms.
[0006] 21 is a control section, and it controls the drive circuit 23, the image recognition circuit 24, etc., reading data with various program data registered into the storage section 22, data about a chip 10, etc. The drive circuit 23 drives a motor 5, the Y motor 9, and the X motor 13. Moreover, the image recognition circuit 24 recognizes the image data incorporated by the camera 4 for substrate recognition,

and the camera 19 for chip recognition.
[0007] This conventional electronic-parts mounting equipment is constituted as mentioned above, and explains the mounting approach of a chip below. Before carrying out migration loading of the chip 10 with which the parts feeder 20 was equipped at a substrate 15, location recognition of a nozzle 2 is performed as follows first. That is, a head 1 is in a zero O location at the beginning, drives a motor 9 there, and is made to move it to the location expected that the camera 4 for substrate recognition puts a mark 18 into the visual field. The migration length from the zero O location at this time is X1 and Y1.
[0008] Next, a mark 18 is observed with the camera 4 for substrate recognition. Drawing 14 shows the image of the visual field of the camera 4 for the substrate recognition at this time. In drawing 14 , the image which carried out black painting is an image of the mark 18 at this time, and the coordinates of the initial valve position of the image of the mark 18 in the system of coordinates (X, Y) set up in the visual field of the camera 4 for substrate recognition are (MX0, MY0). Here, the physical relationship (both distance) of the camera 4 a nozzle 2 and for substrate recognition is regularity (known), and the location of a nozzle 2 is also able to be checked by having checked the original location of a mark 18 as mentioned above with the camera 4 for substrate recognition.
[0009] If the original location of a nozzle 2 is checked by observing a mark 18 with the camera 4 for substrate recognition as mentioned above, the substrate recognition mark (not shown) currently formed on the substrate 15 will be observed with the camera 4 for substrate recognition, the location of a substrate 15 will be recognized, and mounting to the substrate 15 of a chip 10 will be started after that. That is, by driving the X motor 13 and the Y motor 9 in drawing 13 , moving a nozzle 2 to the upper part of a parts feeder 20, driving a motor 5 there, and making vertical actuation perform for a nozzle 2, vacuum adsorption is carried out and the chip 10 with which the lower limit section of a nozzle 2 was equipped at the parts feeder 20 is taken up.
[0010] Subsequently, a nozzle 2 moves to the upper part of the camera 19 for chip recognition, as shown in drawing 13 , it observes the chip 10 by which vacuum adsorption was carried out with the camera 19 for chip recognition for a nozzle 2, and performs location recognition of a chip 10. And a chip 10 is carried in the predetermined coordinate location of a substrate 15 by making the predetermined distance migration of the nozzle 2 carry out in the direction of X, or the direction of Y, and making vertical actuation perform for a nozzle 2 there based on the location of the substrate 15 recognized to be this recognition result. By repeating the above actuation, the chip 10 of a parts feeder 20 is carried in the substrate 15 one after another.
[0011] By the way, while carrying the chip 10 of a parts feeder 20 in the substrate 15 as mentioned above, a holder 3 carries out heat expansion by generation of heat of a motor 5, consequently the location of the camera 4 for substrate recognition changes. Since location recognition of the helicopter loading site of a chip 10 is performed based on the observation result of the camera 4 for this substrate recognition, this change appears as a gap of the helicopter loading site to the substrate 15 of a chip 10, and since the mounting precision to the substrate 15 of a chip 10 falls, it is necessary to perform that amendment. It is there, next the conventional amendment approach based on this heat expansion is explained.
[0012] That is, the camera 4 for substrate recognition is moved to the migration length X1 and Y1 again mentioned above from zero 0 location, and a mark 18 is again observed with the camera 4 for substrate recognition. In drawing 14 , the image without white is an image of the mark 18 at this time. then, the location (MX1, MY1) of this image -- asking -- an initial valve position (MX0, MY0) -- relative -- it shifts and delta X1 and delta Y1 are calculated. It is generated by location fluctuation of the camera 4 for [this] the substrate recognition accompanying [shift and] heat expansion of a holder 3 in delta X1 and delta Y1.
[0013] Thus, although mounting to the substrate 15 of a chip 10 will be resumed if it shifts and delta X1 and delta Y1 are calculated, a chip 10 is mounted in a substrate 15, amending these gaps delta X1 and delta Y1 by [this] shifting and deducting delta X1 and delta Y1 in this case from the movement magnitude of the direction of X of the nozzle 2 by the drive of motors 13 and 9, and the direction of Y. Detection of the above-mentioned gaps delta X1 and delta Y1 is performed suitably (whenever it mounts

a chip 10 in 100 substrates 15).
[0014]
[Problem(s) to be Solved by the Invention] However, there were the following troubles in the mounting approach of the above-mentioned conventional chip. Namely, the above-mentioned conventional approach is premised on the relative physical relationship (distance between the cameras 4 a nozzle 2 and for substrate recognition) of the camera 4 a nozzle 2 and for substrate recognition being constancy. However, the physical relationship of the camera 4 a nozzle 2 and for substrate recognition changes with heat expansion of the holder 3 by generation of heat of a motor 5 in fact. However, by the above-mentioned conventional approach, since this change was not taken into consideration, the trouble that mounting precision fell with heat expansion of a holder 3 had it. Since the mounting precision of a chip demanded tends to become severe in recent years, it is becoming impossible to disregard the fall of the mounting precision accompanying heat expansion of a holder 3 especially.
[0015] Then, this invention aims at offering the mounting approach of the chip which can cancel the fall of the mounting precision of the chip accompanying heat expansion of the holder with which the camera for a head and substrate recognition was attached in one.
[0016]
[Means for Solving the Problem] For this reason, this invention detects a location gap of the nozzle by heat expansion of the holder accompanying generation of heat of the motor which drives a head with the camera for chip recognition. It is made to carry out migration loading of the chip at a substrate, detecting a location gap of the camera for substrate recognition by heat expansion by observing the mark of a predetermined location with the camera for this substrate recognition, and amending the migration stroke of a head based on these detected location gaps.
[0017]
[Function] According to the above-mentioned configuration, a location gap of a nozzle is detected by the camera for chip recognition, and a location gap of the camera for substrate recognition itself is detected by the camera for substrate recognition, but the location gap which doubled these two location gaps is a gap of the relative physical relationship of the camera for a nozzle and substrate recognition by heat expansion of a holder. Therefore, a chip is mounted, amending the migration stroke of a head in consideration of two location gaps.
[0018]
[Example] Hereafter, the example of this invention is explained, referring to a drawing. For the side elevation of the electronic-parts mounting equipment of the first example of this invention, and drawing 2 , the flow chart of this initialization process and drawing 3 are [drawing 1 / the recognition image Fig. of this mark and drawing 5 of the flow chart of this nozzle location amendment process and drawing 4] the recognition image Figs. of this nozzle. Since the electronic-parts mounting equipment shown in drawing 1 is the same as the conventional example shown in drawing 13 , the explanation is omitted.
[0019] First, an initialization process is explained with reference to the flow chart of drawing 2 . first -- up to the location expected that a mark 18 goes into the visual field of the camera 4 for substrate recognition in drawing 1 -- a head 1 -- the distance X1 from a zero O location -- it is made to move Y1 (step 1) In this condition, as shown in drawing 1 , a mark 18 goes into the visual field of the camera 4 for substrate recognition. Then, a mark 18 is observed with the camera 4 for substrate recognition (step 2), an initial valve position (see the initial valve position (MY0, MY0) of the mark 18 shown by the black dot in drawing 4) is detected in the image recognition circuit 24 (step 3), and the data is stored in the storage section 22 (step 4). Drawing 4 is an image at this time, and drawing 4 is the same as drawing 14 . Actuation of steps 1-4 explained above is the same as the conventional approach mentioned above.
[0020] next -- up to the location where a nozzle 2 is expected to go into the visual field of the camera 19 for chip recognition -- a head 1 -- the direction of X from a zero 0, and the direction of Y -- distance X2 -- it is made to move Y2 (step 5) Then, a nozzle 2 is dropped (step 6), a nozzle 2 is observed with the camera 19 for chip recognition (step 7), the initial valve position (NX0, NY0) of a nozzle 2 is detected (step 8), and the data is stored in the storage section 22 (step 9). Drawing 5 is an image at this time.
[0021] If an initialization process is completed as mentioned above, the chip 10 of a parts feeder 20 is

mounted in the substrate 15 next. Since this mounting approach is the same as that of the conventional example mentioned above, that explanation is omitted.

[0022] As mentioned above, while mounting a chip 10 in a substrate 15, a holder 3 carries out heat expansion by generation of heat of a motor 5, and the location of the camera 4 for substrate recognition or the nozzle 2 of a head 1 changes. The amendment approach of a location gap of the mounting position of the chip produced for a location gap of the nozzle 2 which is there, next originates in this heat expansion is ** explained with reference to the flow chart of drawing 3 .

[0023] First, only X1 and Y1 move a head 1 in the direction of X, and the direction of Y from a zero 0 (step 11), a mark 18 is observed with the camera 4 for substrate recognition (step 12), and the location (see the coordinate location (MX1, MY1) of a mark 18 shown without white in drawing 4) of a mark 18 is detected in the image recognition circuit 24 (step 13). Next, by the control section 21, the amounts delta X1 and delta Y1 of location gaps of a mark 18 shown in drawing 4 are calculated (step 14). This delta X1 and delta Y1 are the amount of location gaps of the camera 4 for substrate recognition by heat expansion of a holder 3, and it is calculated from a difference with the initial valve position (MX0, MY0) of a mark 18.

[0024] Next, a head 1 is moved to the upper part of the camera 19 for a location, i.e., chip recognition, which is distant from a zero 0 (X2, Y2) (step 15). Then, a nozzle 2 is dropped (step 16), a nozzle 2 is observed with the camera 19 for chip recognition (step 17), and the location (see the coordinate location (NX1, NY1) of the nozzle 2 shown without white in drawing 5) of a nozzle 2 is detected in the image recognition circuit 24 (step 18). Drawing 5 shows the image at this time, and asks for the location gaps delta X2 and delta Y2 of a nozzle 2 by the control section 21 from a difference with the initial valve position (NX0, NY0) of a nozzle 2 (step 19). Next, correction value delta X and delta Y is calculated by the degree type by the control section 21 (step 20).

[0025] This delta X and delta Y are stored in delta X=delta X1+deltaX2delta Y=delta Y1+deltaY2 order at the storage section 22 (step 21). This correction value delta X and delta Y is the amount of location gaps of the camera 4 for substrate recognition, and the relative physical relationship of a nozzle 2 accompanying heat expansion of a holder 3.

[0026] Although mounting of a chip 10 to a substrate 15 will be resumed if correction value delta X and delta Y is calculated as mentioned above If it amends in mounting of the chip 10 after this by deducting the above-mentioned correction value delta X and delta Y from the migration stroke of a head 1 Mounting of a chip 10 will be performed amending a location gap of the head 1 accompanying heat expansion of a holder 3, and a high mounting precision can be secured.

[0027] Next, the second example of this invention is explained. Drawing 6 is the side elevation of the electronic-parts mounting equipment of the second example of this invention and the image Fig. of the mark according [drawing 7 / drawing 10] in the perspective view of this important section, and drawing 8 to the camera for [drawing 11 / the recognition image Fig. of this mark, and] this chip recognition in the recognition image Fig. of this nozzle, and drawing 12 according [the flow chart of this initialization process and drawing 9] to the flow chart of this nozzle location amendment process.

[0028] As for this second example, the recognition structure of a mark differs from the first example. That is, in drawing 6 and drawing 7 , 30 is a mark unit and is constituted as follows. 31 is a box of a body and it is equipped with the cylinder 32 with the bracket 37. The rod 33 of a cylinder 32 is located horizontally on the top face of the box 31 of a body, the slider 35 is combined with the point, and the transparent plate 34 is combined with the slider 35. The mark 18 is formed in this plate 34. 36 is a guide rail to which it shows sliding of a slider 35. Therefore, if the rod 33 of a cylinder 32 projects to the front, as shown in the chain line and drawing 7 of drawing 6 , a plate 34 can observe a projection and a mark 18 with the camera 19 for chip recognition to the upper part of the camera 19 for chip recognition. Moreover, if the rod 33 of a cylinder 32 draws, a plate 34 will leave from the upper part of the camera 19 for chip recognition. That is, the camera 19 for this chip recognition performs recognition of a chip 10, and recognition of a mark 18.

[0029] Next, an initialization process is explained with reference to drawing 8 . In drawing 8 , the same step number is given to the same step as drawing 2 . First, make the rod 33 of a cylinder 32 project, a

plate 34 is made to project on the camera 19 for chip recognition, before operating step 1, and a mark 18 is located in the visual field of the camera 19 for chip recognition (step 0). Steps 1-4 are the same as steps 1-4 of drawing 2 , and omit explanation.
[0030] A mark 18 is observed with the camera 19 for chip recognition at step 4-1, an initial valve position (MCX0, MCY0) is detected at step 4-2 in the image recognition circuit 24, and the data is stored in the storage section 22 at step 4-3. As shown in drawing 12 , the amount of protrusions of a plate 34 is adjusted so that a mark 18 (black dot) may be located in the center of the visual field of the camera 19 for chip recognition. Thus, if the initial valve position (MCX0, MCY0) of the mark 18 seen from the camera 19 for chip recognition is recognized, the rod 33 of a cylinder 32 can be drawn at step 4-4, and a plate 35 will be made to leave from the camera 19 for chip recognition. Next, although steps 5-9 are operated, since these steps 5-9 are the same as steps 5-9 of drawing 2 , that explanation is omitted.
[0031] Next, a nozzle location amendment process is explained with reference to drawing 9 . Since step 11 of the second example - step 13 and step 15 - step 21 are the same as the first example of drawing 3 , explanation is omitted. A plate 34 is made to project to the upper part of the camera 19 for chip recognition [before performing step 11 first] (step 10). And a mark 18 is observed with the camera 19 for chip recognition at step 13-1, and the location (MCX1, MCY1) of a mark 18 is detected at step 13-2.
[0032] Although it was adjusted at the initialization process so that a mark 18 (black dot) might be located at the core of the camera 19 for chip recognition as drawing 12 showed, the mark 18 (white round head) has projected at the nozzle location amendment process in the location which carried out the location (delta X3, delta Y3) gap. Although this is the location gap resulting from dispersion in actuation of a cylinder 32, unless it takes this location gap into consideration, it cannot ask for an exact location gap (delta X1, delta Y1) of the camera 4 for substrate recognition. Therefore, at step 14, it asks for a location gap (delta X1, delta Y1) of the camera 4 for substrate recognition from the following formulas.
[0033]
a plate 34 is left to deltaX1=MX1-MX0+MCX1-MCX0deltaY1=MY1-MY0+MCY1-MCY zero-order from the camera 19 for chip recognition at step 14-1 -- making -- the following first example -- the same -- carrying out -- correction value deltaX -- it deltaY asks and stores in the storage section 22. Various concrete means for observing a nozzle 2 and a mark 18 are possible so that clearly from each above example.
[0034]
[Effect of the Invention] As explained above, according to this invention, the fall of the mounting precision by heat expansion of a holder is canceled, and a chip can be carried in a substrate in a high location precision.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The side elevation of the electronic-parts mounting equipment of the first example of this invention
[Drawing 2] The flow chart of the initialization process of the electronic-parts mounting equipment of the first example of this invention
[Drawing 3] The flow chart of the nozzle location amendment process of the electronic-parts mounting equipment of the first example of this invention
[Drawing 4] The recognition image Fig. of the mark of the electronic-parts mounting equipment of the first example of this invention
[Drawing 5] The recognition image Fig. of the nozzle of the electronic-parts mounting equipment of the first example of this invention
[Drawing 6] The side elevation of the electronic-parts mounting equipment of the second example of this invention
[Drawing 7] The perspective view of the important section of the electronic-parts mounting equipment of the second example of this invention
[Drawing 8] The flow chart of the initialization process of the electronic-parts mounting equipment of the second example of this invention
[Drawing 9] The flow chart of the nozzle location amendment process of the electronic-parts mounting equipment of the second example of this invention
[Drawing 10] The recognition image Fig. of the mark of the electronic-parts mounting equipment of the second example of this invention
[Drawing 11] The recognition image Fig. of the nozzle of the electronic-parts mounting equipment of the second example of this invention
[Drawing 12] The image Fig. of a mark with the camera for chip recognition of the electronic-parts mounting equipment of the second example of this invention
[Drawing 13] The side elevation of conventional electronic-parts mounting equipment
[Drawing 14] The recognition image Fig. of the mark of conventional electronic-parts mounting equipment
[Description of Notations]
1 Head
2 Nozzle
3 Holder
4 Camera for Substrate Recognition
5 Motor
6 Y Table
10 Chip
11 X Table
15 Substrate

19 Camera for Chip Recognition
20 Parts Feeder
21 Control Section

[Translation done.]

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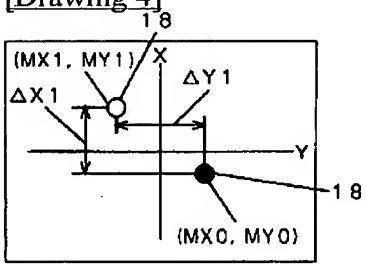
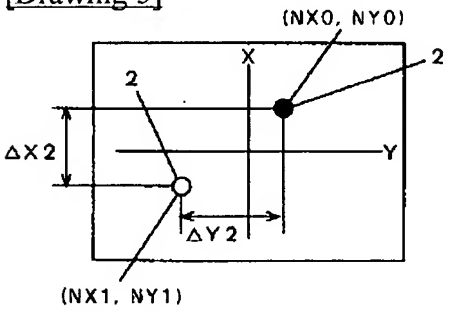
DRAWINGS

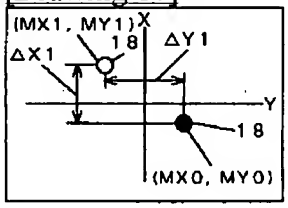
[Drawing 4]



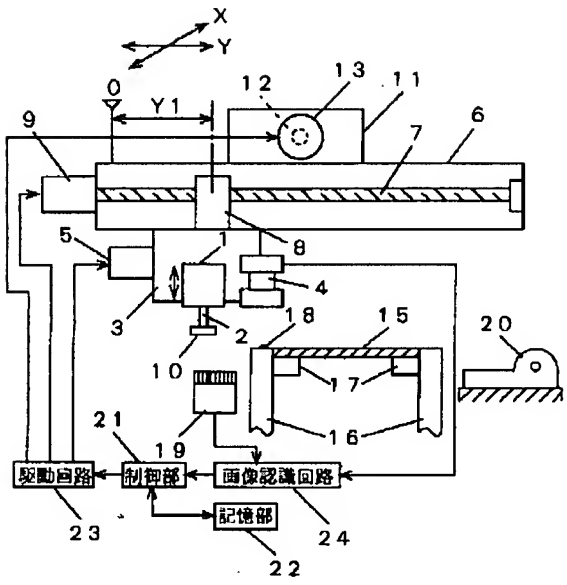
[Drawing 5]



[Drawing 10]

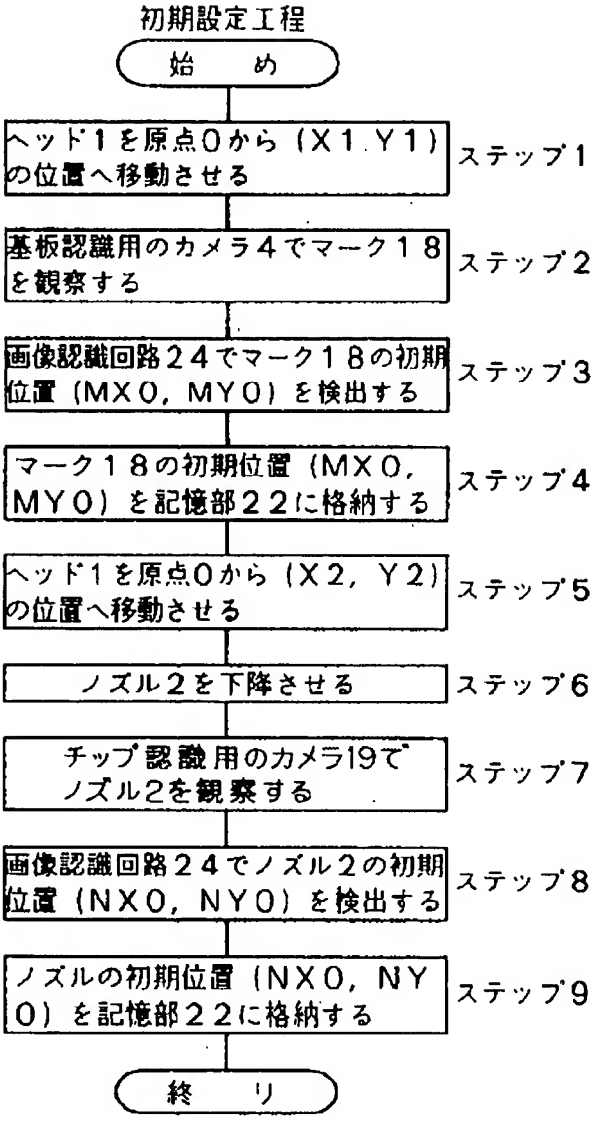


[Drawing 1]

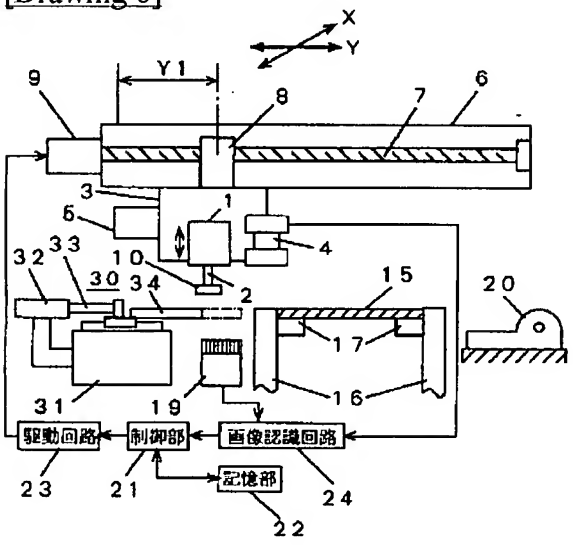


1 ヘッド
2 ノズル
3 ホルダ
4 基板認識用のカメラ
5 モータ
6 Yテーブル
10 チップ
11 Xテーブル
15 基板
19 チップ認識用のカメラ
20 パーツフィーダ

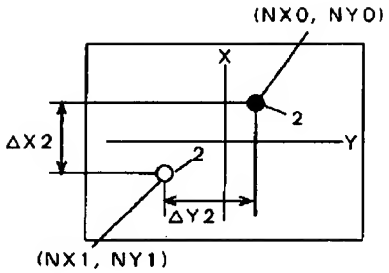
[Drawing 2]



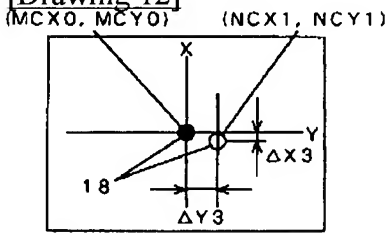
[Drawing 6]



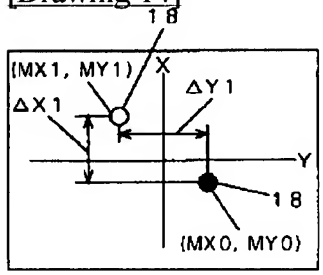
[Drawing 11]



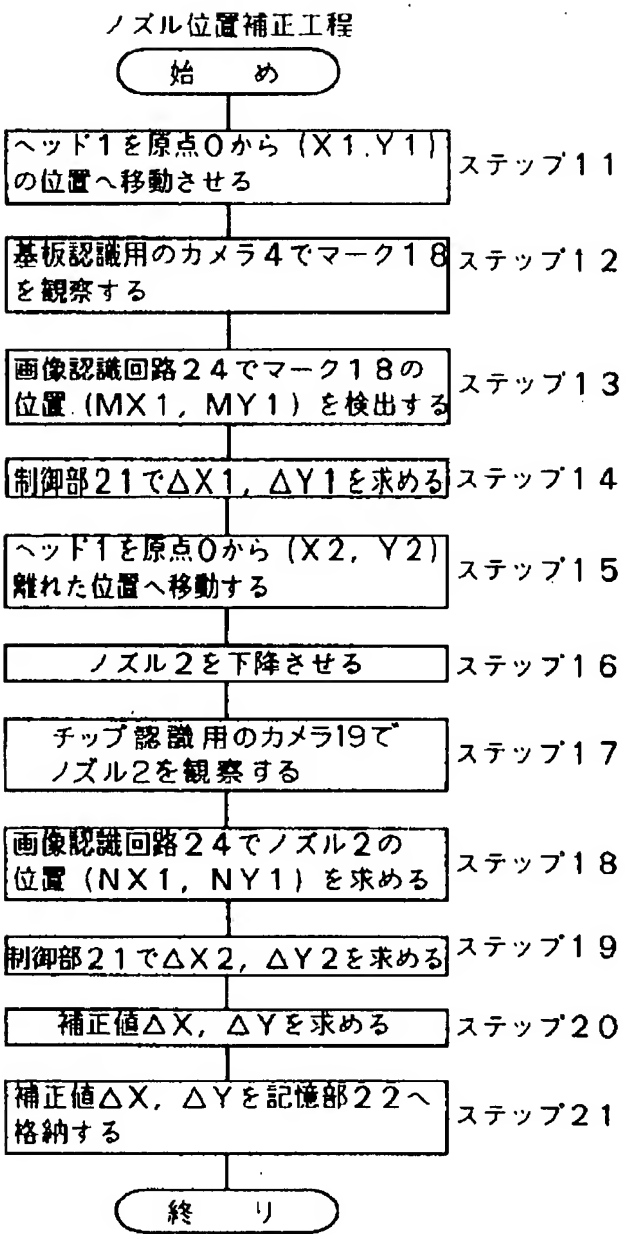
[Drawing 12]



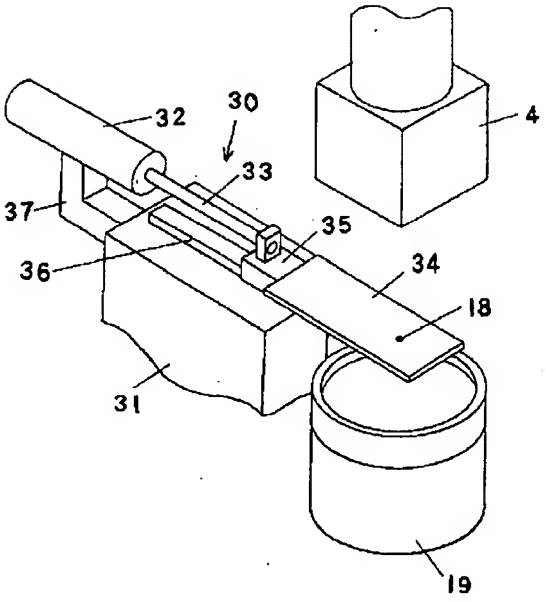
[Drawing 14]



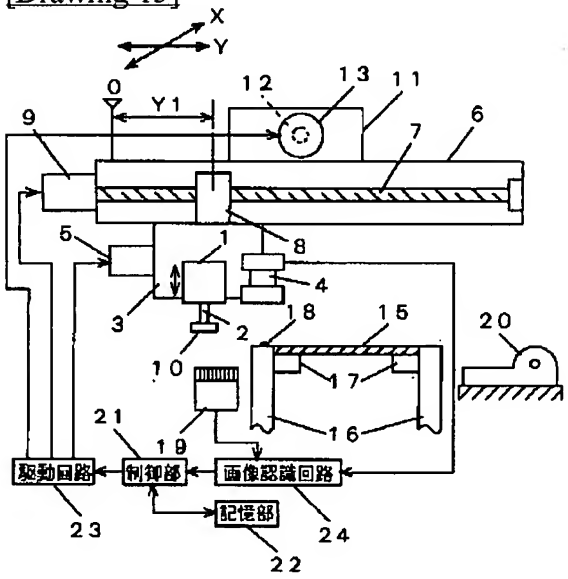
[Drawing 3]


ノズル位置補正工程
始　め
ヘッド1を原点0から（X1,Y1）の位置へ移動させる
ステップ11
基板認識用のカメラ4でマーク18を観察する
ステップ12
画像認識回路24でマーク18の位置（MX1，MY1）を検出する
ステップ13
制御部21でΔX1，ΔY1を求める
ステップ14
ヘッド1を原点0から（X2，Y2）離れた位置へ移動する
ステップ15
ノズル2を下降させる
ステップ16
チップ認識用のカメラ19でノズル2を観察する
ステップ17
画像認識回路24でノズル2の位置（NX1，NY1）を求める
ステップ18
制御部21でΔX2，ΔY2を求める
ステップ19
補正値ΔX，ΔYを求める
ステップ20
補正値ΔX，ΔYを記憶部22へ格納する
ステップ21
終　り

[Drawing 7]



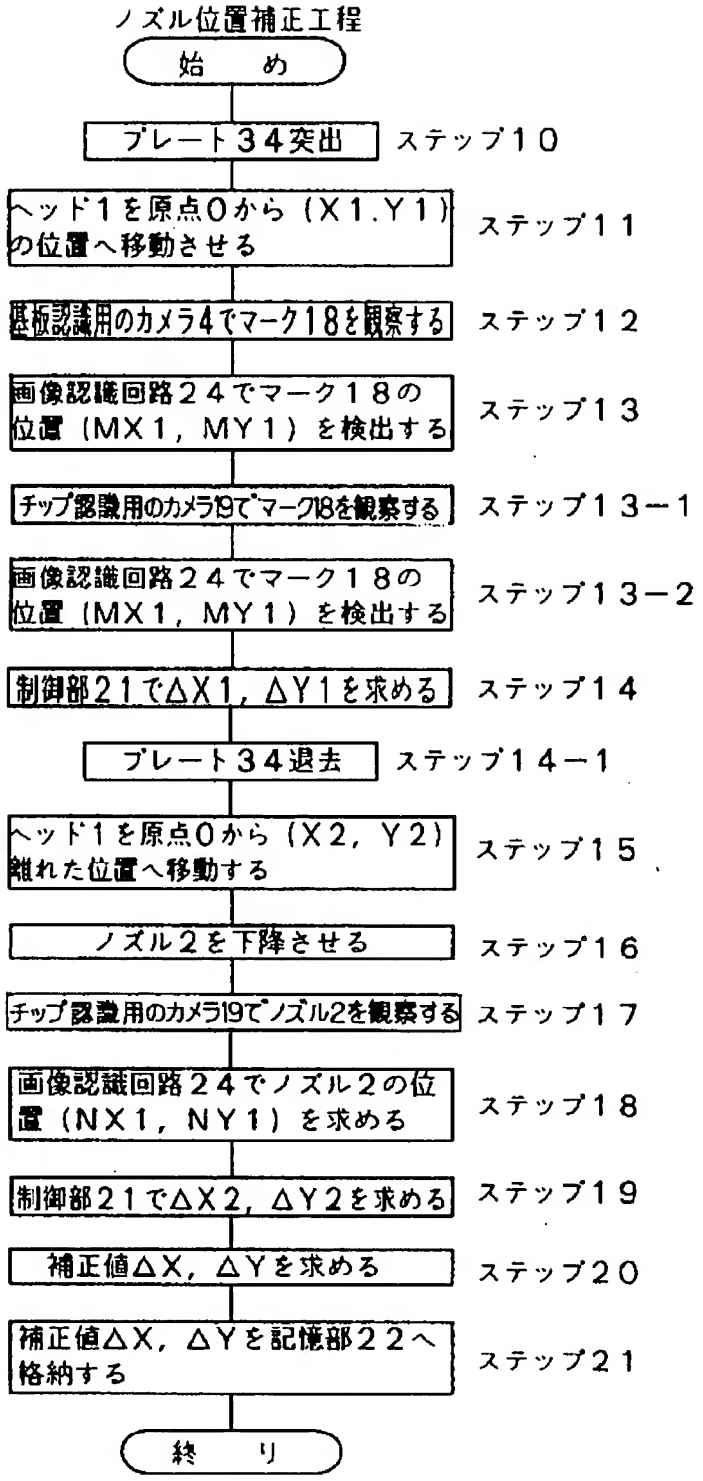
[Drawing 13]



[Drawing 8]


初期設定工程
始　め
プレート３４突出
ステップ０
ヘッド１を原点０から（Ｘ１，Ｙ１）の位置へ移動させる
ステップ１
基板認識用のカメラ４でマーク１８を観察する
ステップ２
画像認識回路２４でマーク１８の初期位置（ＭＸ０，ＭＹ０）を検出する
ステップ３
初期位置（ＭＸ０，ＭＹ０）を記憶部２２に格納する
ステップ４
チップ認識用のカメラ19でマーク18を観察する
ステップ４－１
初期位置（ＭＣＸ０，ＭＣＹ０）を画像認識回路２４で検出する
ステップ４－２
初期位置（ＭＣＸ０，ＭＣＹ０）を記憶部２２に格納する
ステップ４－３
プレート３４退去
ステップ４－４
ヘッド１を原点０から（Ｘ２，Ｙ２）の位置へ移動させる
ステップ５
ノズル２を下降させる
ステップ６
チップ認識用のカメラ19でノズル2を観察する
ステップ７
画像認識回路２４でノズル２の初期位置（ＮＸ０，ＮＹ０）を検出する
ステップ８
ノズル２の初期位置（ＮＸ０，ＮＹ０）を記憶部２２に格納する
ステップ９
終　り

[Drawing 9]



[Translation done.]